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A STUDY OF MITCHELL'S INQUIRIES INTO PRICES ¹

SUMMARY

I. Introductory. Method and purpose of this paper; Mitchell's figures subjected to more refined methods, 656. — II. Comparison of wholesale and retail prices, 658; lag of retail prices not clearly established, 659. — Producers' goods and consumers' goods; examination of annual, quarterly and monthly data, 660. — III. Raw materials, partly manufactured and finished goods move concurrently, 663. — Influence of raw materials eliminated, 664. — Dissimilar price fluctuations of producers' and consumers' goods, 665. — IV. Organic and inorganic goods; Sombart's theory tested, 666. — V. Wages in England and United States; closer relation between wages and wholesale prices in the former, 668. — VI. Summary and conclusions. Mitchell confirmed in part only, 671. — Annual figures not necessarily homogeneous; quarterly figures suggested, 673.

I

MITCHELL'S *Business Cycles* is justly characterized by reviewers of the work as "the most complete and careful study of the phenomena connected with business cycles,"² and "by far the most elaborate treatise on the subject that has yet appeared in the English language."³ Another writer remarks that "altho much still remains to be done in the field of the business cycle, the value of Professor Mitchell's contribution to our knowledge of the subject can hardly be overestimated."⁴ Mitchell goes into the world of facts, selects data, constructs

¹ I am indebted to Professor W. M. Persons for suggesting this inquiry, which was carried on in connection with the graduate course on statistics conducted by him at Harvard University during the past academic year.

² Quarterly Journal of Economics, vol. xxviii, pp. 795-810 (Persons).

³ Economic Journal, vol. xxiv, pp. 78-80 (Pigou).

⁴ Journal of Political Economy, vol. xxiv, pp. 609-611 (Sprague).

index numbers, plots curves. This done, he interprets the results. His deductions and interpretations are based mainly on annual data presented in graphic form. The degree of fluctuation, the correspondence or lack of correspondence of the cyclical movements, the amount of lag of the fluctuations of one series as compared with those of another, is by inspection of the simple graphs. It is this subjective method which the present paper considers and tests. No endeavor is here made to present additional data, or to revise in any way the material so admirably presented by Mitchell. The purpose is simply to introduce more objective methods of testing the validity of his conclusions.

Not every table or chart or conclusion in Mitchell's book will be examined, but only those which are closely related to the problem at hand and are not so obvious as to be generally accepted.¹ The price series used throughout are in the form of index numbers based upon the arithmetic average 1890-99 as 100. Unless otherwise specified the figures represent annual data. Where in any series figures are wanting, the corresponding figures in the series with which it is compared are elided in the interest of consistency.

I shall bring to the task of testing the cyclical movements of the respective price series the Pearsonian coefficient of correlation.² Considerations of accuracy as well as of ease of calculation lead me to correlate *first differences*³ rather than *cycles*. Each series will ordi-

¹ For example, the relations which Mitchell finds existing between interest rates on bonds, commercial paper and call loans are easily discerned from the graphs and generally accepted by economists. The same might be said of other series. Cf. Mitchell, *Business Cycles*, pp. 140-56.

² For a discussion of this device and its practical application see Yule, *An Introduction to the Theory of Statistics*, chaps. 9 and 10.

³ So long as the secular trend is linear the results obtained by the method of first differences have in a number of independent tests been found by Professor Warren M. Persons to be substantially the same as those obtained by the more involved but no more accurate method of cycles. For a comparison of the practical results of these two

narily be compared with another series concurrently and also for a lag in both directions. The expressions "previous," "concurrent," and "lag" in the tables which follow invariably refer to the last named of the series paired. The index of correlation is carried to two places only, since the probable inaccuracy of the original data will not justify further refinement.

For the purposes of the present inquiry it is a matter of indifference whether relative dispersion be measured by the standard deviation or by the coefficient of variation.¹ For convenience I shall ordinarily use the standard deviation of the first differences. In certain instances the other criterion may be introduced as a check on the results.

II

Mitchell finds that the retail prices of thirty staple foods as compiled by the United States Bureau of Labor show a "certain correspondence" with business conditions, despite the fact that "the supply of vegetable and animal foods varies in an arbitrary fashion determined by the weather and the demand for staple foods is less affected by prosperity and depression than that of more dispensable commodities."²

methods the reader is referred to an article by Professor Persons on the "Construction of a Business Barometer" in the *American Economic Review* for December, 1916, vol. vi, pp. 739-69, especially pp. 755 ff. A recent theoretical discussion of this method by the same author appears in the *Quarterly Publications of the American Statistical Association*, vol. xvi, no. 118, June, 1917. Tho this coefficient is smaller than that of the cycles, it has the advantage of being more sensitive than the latter to variations in the series compared. Besides, for the present purpose not absolute size but the relation existing between the coefficients is the important thing.

¹ Cf. Yule, *An Introduction to the Theory of Statistics*, pp. 134-44, and 149. The standard deviation of first differences differs from that of the original series merely in size. Both may be equally relied upon as a measure of relative fluctuation. The justification for the employment of the standard deviation lies in the fact that the series compared are in the form of index numbers based on the arithmetic average 1890-99 as 100, which may therefore be said to be made up of comparable units. The small amount of error due to the fact that the arithmetic mean for the entire series may not be 100 may for present purposes be ignored.

² Mitchell, *Business Cycles*, p. 95.

In the comparison of consumers' goods at wholesale and at retail, satisfactory results can be obtained only by comparing series which contain the same classes of commodities. Since the currently published index numbers do not meet this test, Mitchell finds it necessary to reconstruct the two series upon the basis of figures obtained from the Bureau of Labor Bulletin. Average relative prices for twenty-five commodities¹ are accordingly arranged in two series — at wholesale and at retail — and two curves are plotted from these figures.² Mitchell observes that "while these two series agree closely in the general trend of fluctuations, the retail prices are much more stable. They lag behind wholesale prices both on the rise and on the fall, but more on the fall than on the rise."³

The correlation of relative prices at retail with relative prices at wholesale of twenty-five staple foods⁴ yields the following results:

TABLE I. — TWENTY-FIVE STAPLE FOODS AT WHOLESALE AND RETAIL (1890-1907)

(The expressions "previous," "concurrent" and "lag" refer to the last named of the series paired)

Series Correlated	Coefficients of Correlation		
	One Year Previous	Concurrent	One year Lag
Retail prices and wholesale prices	+ .09	+ .72	+ .15

It is clear from this test that Mitchell's contention that the series move together is not without foundation, since there is a considerable degree of correlation between them (+ .72). But it is to be noted also that the point of highest agreement appears in the concurrent data as distinguished from a lag in either direction. The slightly higher degree of correlation for the one year lag

¹ Mitchell, *Business Cycles*, p. 96, note 9.

² *Ibid.*, p. 98.

³ *Ibid.*, p. 97.

⁴ *Ibid.*, Table 3, Chart 1, p. 97.

than for the previous year is not significant, since the difference is small and the coefficient low.

The greater stability in retail prices than in wholesale prices is indicated by their standard deviations, 4.2 and 6.8 respectively.

Mitchell asserts further that as between producers' and consumers' goods the same phenomenon appears. "As consumers' goods at retail are more stable in price than the same goods at wholesale, so consumers' goods even at wholesale, are more stable in price than producers' goods. . . . The availability of data by months for recent years makes it possible to carry out this comparison in detail for the period including the latest crisis, depression and revival of business activity.

"The comparison by months shows that producers' goods reached their highest point earlier in 1907 than consumers' goods, and were on the down-grade several months before the panic broke out. Their decline in 1908 was also greater in degree, their recovery began sooner and proceeded at a faster pace. In brief, within short periods as within long, the prices of producers' goods appear to be decidedly more sensitive than prices of consumers' goods to alterations in business conditions."

Let us apply our tests first to the annual data on this topic. So far as the degree of fluctuation is concerned, consumers' goods show more stability than producers' goods, since the standard deviation of the former is 4.7, while that of the latter is 5.8. But in point of time the prices of both types of goods move together. The two series correlate with each other most closely for the same year (+.74), while the correlation of consumers' goods with producers' goods for the previous year is but moderate (+.41), and the agreement for the lag of one

year is of no significance. Again, there is some tendency for the prices of producers' goods to move earlier than those of consumers' goods, but the tendency is not marked.

TABLE II. — CONSUMERS' AND PRODUCERS' GOODS AT WHOLESALE IN THE UNITED STATES (1890-1910) ¹

Series Correlated	Coefficients of Correlation		
	One Year Previous	Concurrent	One Year Lag
Consumers' goods and producers' goods	+.41	+.74	+.05
Series	Standard Deviations		
Producers' goods	5.8		
Consumers' goods	4.7		

It will now be interesting to look for a moment at the monthly data, which run through the business cycle of 1907. Tho Mitchell has not charted the monthly figures I feel warranted in examining them, since he brings the monthly as well as the annual data to the support of his conclusions. I have correlated these two monthly series ² with each other for concurrent months and for lags of three-month intervals in each direction with results which, tho low, may be said to be of some significance. As in the case of the annual figures, the concurrent correlation is the highest (+.36). The other coefficients are either low or negative, with the possible exception of that resulting from the correlation of the prices of consumers' goods with producers' goods for six months previous (+.27). This, if it indicates anything at all, signifies a slight tendency of the prices of producers' goods to move before those of consumers' goods. It should be observed that these coefficients do not descend gradually from the highest point in each direction as do those of the quarterly figures which appear later.

¹ For series correlated see Mitchell, *Business Cycles*, Table 4, p. 98.

² *Ibid.*, Table 4, p. 99.

TABLE III. — CONSUMERS' AND PRODUCERS' GOODS AT WHOLESALE IN THE UNITED STATES

(By months, January, 1907 to December, 1910, inclusive)

Series Correlated	Coefficients of Correlation
Consumers' goods and producers' goods:	
Twelve months previous	— .09
Nine months previous	+ .19
Six months previous	+ .27
Three months previous	+ .13
Concurrent	+ .36
Three months lag	— .09
Six months lag	— .10
Nine months lag	— .08

Turn now to the results for quarters. They are more in accord with Mitchell's conclusions. Inasmuch as he does not present quarterly figures, I have resolved his monthly series, 1907–1910,¹ into quarterly series by means of a three-month arithmetic average. This treatment of his data, however, reduces the number of items in each series to fifteen at most, and thereby impairs measurably the reliability of the respective indices of correlation. Here the highest degree of correlation is perceived when prices of consumers' goods for the current quarter are correlated with those of producers' goods for the previous quarter (+.46). The correlation for the second previous quarter (+.37) is equally as high as the concurrent correlation (+.36). The agreement with the third previous quarter (+.21) is too low to be of any significance. The least harmony occurs between consumers' goods for the current quarter and producers' goods for the second subsequent quarter (–.24). It should be noted that the results diminish regularly from the maximum in each direction. What I have just presented is the strongest evidence I can find from the material at hand that the prices in question

¹ Business Cycles, Table 4, p. 99.

behave in the manner suggested by Mitchell. Unfortunately, the lack of sufficient data precludes any definite conclusion.

TABLE IV. — PRODUCERS' AND CONSUMERS' GOODS AT WHOLESALE IN THE UNITED STATES

(By quarters, January, 1907 to December, 1910, inclusive)

Series Correlated	Coefficients of Correlation
Consumers' goods and producers' goods:	
Four quarters previous	— .01
Three quarters previous	+ .21
Two quarters previous	+ .37
One quarter previous	+ .46
Concurrent	+ .36
One quarters lag	— .05
Two quarters lag	— .24
Three quarters lag	— .14

III

An inquiry into the relation between the prices of finished products and of raw materials from which they are made is significant. Mitchell's comparison of the curves of the relative prices of twenty pairs of raw materials and their manufactured products ¹ indicates "that, whether the comparison be by months or years, the prices of raw materials respond more promptly and in larger measure to changes in business conditions than do the prices of their products." And the introduction of an intermediate curve representing the prices of partly manufactured goods ² leads him to the further conclusion that the degree of steadiness of the prices of goods is a function of their nearness to or remoteness from the raw state.³

The method of correlation does not in this case strengthen Mitchell's position. For if we accept his an-

¹ Mitchell, *Business Cycles*, Chart 2, p. 100, and Table 5, p. 101.

² *Ibid.*, Chart 3, p. 100, Table 5, p. 101.

³ *Ibid.*, p. 102.

nual data as the correct basis and compare the prices of the twenty raw materials with the prices of the twenty manufactured articles, we find the prices of the two series for the same year moving very closely together ($+.94$), while the prices of raw materials for the preceding year agree in a less measure ($+.24$), and for the one year lag not at all ($-.04$).

TABLE V. — TWENTY RAW MATERIALS AND THEIR MANUFACTURED PRODUCTS (1890-1910)

Series Correlated	Coefficients of Correlation		
	One Year Previous	Concurrent	One Year Lag
Manufactured products and raw materials	$+.24$	$+.94$	$-.04$

The author's assertion seems also at variance with the facts revealed in the case of the "five triplets,"¹ the more evidence can here be invoked in his support than in the previous instance. Prices of raw materials move concurrently with prices of partly manufactured products ($+.76$), which latter in turn harmonize with the prices of finished products for the same year in a slightly less degree ($+.69$). And the prices of finished products agree as closely with the prices of raw materials for the concurrent as for the previous year ($+.52$). Correlation for the one year lag is negative. One of the most striking features of the table which follows is the higher correlation of finished products for the current year with raw materials for the previous year ($+.52$) than of partly manufactured products for the current year with raw materials for the preceding year ($+.38$), or with finished products for the succeeding year ($+.32$). Furthermore, the last two coefficients are of approximately the same size. It is just possible that the agreement between the intermediate and other stages of manufacture might have been closer had the period been reduced to quarters.

¹ The phrase quoted refers to three sets of index numbers of prices of five selected commodities in their raw, partly manufactured and finished states.

TABLE VI. — FIVE COMMODITIES IN THEIR RAW, PARTLY MANUFACTURED AND FINISHED STATE (1890-1910)

Series Correlated	The "Five Triplets"		
	One Year Previous	Coefficients of Correlation Concurrent	One Year Lag
Partly manufactured products and raw materials	+ .38	+ .76	-.15
Finished products and raw materials	+ .52	+ .52	-.17
Finished products and partly manufactured products	+ .32	+ .69	-.04

But this greater sensitiveness of raw materials, suggests Mitchell, may mean that consumers' goods are less sensitive than producers' goods because the former are chiefly finished products. He tests this situation by constructing and charting¹ series which contain, not the prices of raw materials, but simply those of consumer's manufactured products on the one hand and producers' manufactured products on the other. Inspection of his graphic presentation leads him to the conclusion that from the point of view of sensitiveness to alterations in business conditions, as well as of the range of the oscillations, producers' manufactured articles occupy a position intermediate between that of raw materials and consumers' goods.

It is true that the indices of variability of the three series, as well as their respective curves,² reveal wider oscillations in the goods as the raw state is approached. Below are the measures of dispersion of the three series in question:

TABLE VII. — DISSIMILAR PRICE FLUCTUATIONS OF PRODUCERS' AND CONSUMERS' GOODS

Series	Coefficients of Variation — Original Series	Standard First Differences	Deviations Original Series
Raw materials, producers' goods	15.9	7.6	18.4
Producers' manufactured goods	11.0	6.8	12.0
Consumers' manufactured articles	8.5	4.7	9.0

¹ Business Cycles, Table 6, p. 103, and Chart 4, p. 103. ² Ibid., Chart 4, p. 103.

It will be observed that, whatever method we pursue, the relation found is that advanced by Carver¹ and accepted by Mitchell in explanation of the business cycle.

But the figures when subjected to the correlation method do not support the proposition that the prices of producers' goods characteristically move earlier in point of time than those of consumers' commodities. For when the price series for consumers' manufactured commodities is compared with that of producers' manufactured commodities for the previous year the degree of agreement is only moderate (+.31), whereas the coefficient of correlation of the concurrent figures is substantial (+.81). Likewise, raw materials compare with producers' manufactured articles most favorably when the figures compared are for the same year (+.87).

TABLE VIII. — RAW MATERIALS AND MANUFACTURED COMMODITIES USED BY PRODUCERS AND BY CONSUMERS (1890-1910)

Series Correlated	Coefficients of Correlation		
	One Year Previous	Concurrent	One Year Lag
Manufactured articles used by consumers, and manufactured articles used by producers	+.31	+.81	+.02
Raw materials used by producers, and manufactured articles used by producers	-.00	+.87	+.48

IV

Sombart's theory that business cycles are caused by the different rhythms of production in the organic and inorganic realms suggests to Mitchell a comparison of the prices of minerals, the characteristic inorganic raw materials, with the prices of organic goods such as forest, animal and farm products.² For the purpose at hand

¹ Quarterly Journal of Economics, May, 1903, vol. xvii, pp. 497-500.

² Mitchell, Business Cycles, Chart 5, p. 105, and Table 7, pp. 106-07. The series are made up of 41 mineral, 19 forest, 41 animal and 58 farm products.

the prices of raw materials only are considered by him, on account of their independence of improvements in the arts. He finds that "of the four series, the inorganic mineral products reflect the business cycles with least distortion for the whole period; but their superiority as a 'trade barometer' over the organic forest products is due chiefly to the steady rise of the latter from 1901 to 1907, . . . due to a gradual reduction in the supplies of lumber within easy reach of the great eastern markets from which the quotations come, and to a closer organization among the lumber interests. . . . In the case of animal and farm products, however, where dependence is not upon natural deposits of minerals, and of forests which have grown through decades, but upon the fruits of human labor during one or two seasons, frequent contradictions between the movements of prices on the one hand and changes in business conditions on the other hand seem likely to continue for an indefinite time to come. Sombart's theory in other words might be more accurately formulated in terms of contrast between goods the supply of which within short periods depends largely upon the weather, and goods the supply of which within short periods depends almost entirely upon the activity of enterprise." ¹

The correlation of these figures yields results which in part corroborate the conclusions set forth. The maximum correlation of mineral products with the other three series is greatest for forest products (+.67), slightly less for animal products (+.38), and practically insignificant in the case of farm products (+.02). The closer concurrent correlation between forest products and the other organic products (farm +.32, animal +.48) than between the inorganic products (minerals) and the same organic goods (farm +.02, animal +.38), is interesting in the light of Mitchell's suggestion that

¹ *Business Cycles*, pp. 108-09.

forest products since 1900 have been losing their force as a business barometer.

The moderate degree of correlation between farm products for the current year and mineral and forest products for the preceding year ($+.42$ and $+.34$ respectively) is worthy of note. It is therefore evident that, to some extent at least, mineral and forest products unite in forecasting the prices of farm products, despite the close dependency of farm production upon weather conditions, and the inelastic nature of the demand curve for agricultural products. So that, unless the relation established is to be interpreted as an accidental coincidence, one is unable to join Mitchell in the assertion that "weather conditions constitute such an important factor that movements initiated in the mineral industries would be but imperfectly reflected in the farming industry."

TABLE IX. — ORGANIC AND INORGANIC GOODS IN THEIR RAW STATE (1890-1910)

Series Correlated	Coefficients of Correlation		
	One Year Previous	Concurrent	One Year Lag
Forest products and mineral products	$+.14$	$+.67$	$-.02$
Animal products and mineral products	$-.18$	$+.38$	$+.18$
Farm products and mineral products	$+.42$	$+.02$	$+.12$
Farm products and forest products	$+.34$	$+.32$	$-.03$
Animal products and forest products	$-.19$	$+.48$	$+.34$
Farm products and animal products	$+.13$	$+.50$	$+.16$

V

Wages remain to be discussed. Mitchell directs attention to the incompleteness of the data ¹ due to the fact that, for the most part, only manufacturing industries are included. But since manufacturing centers exhibit the phenomena of business cycles in a pronounced degree, it is perhaps fortunate that the limita-

¹ The American figures are taken from the United States Bureau of Labor Bulletins of July, 1904-08. The figures are weighted according to the number in each employment in the construction of new series only.

tions are as they are. Mitchell concludes that "the figures indicate that the prices of labor are influenced by changes in business conditions, but in less degree than the prices of commodities at retail," and in a much less degree than those of commodities at wholesale. Further, "the range covered by the relative prices of labor is narrower, and the degree of concentration about the median is greater than with wholesale prices."¹

To what extent are these conclusions justified by the method we are pursuing? In the first place, if wholesale prices may be taken as a barometer of business conditions, retail prices respond more quickly to changes in wholesale prices than do wages. For wholesale prices correlate more closely with the former (+.77) than with the latter (+.57). The fact yet remains that they move concurrently, and that there is a more substantial agreement between wholesale prices for the current year and wages for the following year (+.51) than with retail prices for the following year (+.30). The standard deviations of the first differences of these three series show that the character of the dispersion is as described by Mitchell, greatest for wholesale prices (5.8), less for retail prices (2.4), and least of all for labor (2.2).

TABLE X. — WAGES, AND COMMODITIES AT WHOLESALE AND RETAIL IN THE UNITED STATES (1890-1907)²

Series Correlated	Coefficients of Correlation		
	One Year Previous	Concurrent	One Year Lag
Wages and wholesale prices	+.51	+.57	+.40
Retail prices and wholesale prices	+.30	+.77	+.23
Series	Standard Deviations (First Differences)		
Wholesale prices	5.8		
Retail prices	2.4		
Wages	2.2		

¹ Mitchell, *Business Cycles*, pp. 132, 133.

² Wholesale prices, Dun-Gibson Index Number Improved.

Retail prices of thirty staple foods.

Wages per hour in forty-one manufacturing industries.

Mitchell's investigation of English wages leads him to assert that "English wages pursue a course far more even than do prices at wholesale. But when compared with the Board of Trade's series for the retail prices of food the difference is less marked. . . . Finally, when the English and American index numbers are compared they reflect the differences in the course of business cycles."¹

TABLE XI. — WAGES, AND COMMODITIES AT WHOLESALE AND RETAIL IN ENGLAND (1890-1910)

Series Correlated	Coefficients of Correlation		
	One Year Previous	Concurrent	One Year Lag
Wages and wholesale prices (Sauerbeck)	+ .47	+ .71	— .25
Retail prices and wholesale prices	+ .39	+ .07	— .02
Retail prices and wages	+ .38	+ .18	— .23
Wholesale prices and wages	— .25	+ .71	+ .47
American wages and English wages		+ .49	
Series	Standard Deviations (First Differences)		
Wholesale prices	5.1		
Retail prices	2.7		
English wages	2.2		
American wages	2.2		

In striking contrast to the American results, the present inquiry discloses the fact that, in point of time, English wages move in close harmony with wholesale prices (+.71), while retail prices show but a slight degree of similarity in their fluctuations (+.07). Both series show a moderate degree of correlation with wholesale prices for the previous year. Again, wages agree more closely with retail prices for the following year (+.38) than for the previous year (— .23).

So far as the degree of fluctuation is concerned, it appears that wages do pursue a course far more even

¹ Mitchell, *Business Cycles*, pp. 136 and 139. Mitchell points out that English wage statistics are less reliable than the American data in that "while agriculture and coal-mining are included, the manufacturing industries are by no means so well represented" as in the American figures.

(2.2) than do prices at wholesale (5.1); and when compared with retail prices the difference is less marked (2.7).

VI

We may now conclude and summarize.

It is clear from this analysis — which rests, be it remembered, on annual data — that the prices of consumers' goods at retail do not lag behind the same goods at wholesale in the manner indicated by Mitchell, but move concurrently with slightly differing ranges of fluctuation. Producers' goods, further, exhibit a wider range of fluctuation than consumers' goods even at wholesale. But an examination of the monthly as well as of the annual figures does not enable one to confirm Mitchell's assertion that "within short periods as within long the prices of producers' goods appear to be decidedly more sensitive than the prices of consumers' goods to alterations in business conditions." We must turn to quarterly series, constructed from the monthly figures 1907–1910 inclusive, which, tho inadequate, constitute the only available evidence that the prices of consumers' and producers' goods do move in the manner indicated by Mitchell. Even here the evidence is not unmistakable.

The sensitiveness¹ of prices of commodities to business conditions does not appear to be a function of the proximity to or remoteness from the raw state. A comparison of the annual figures of twenty pairs of raw materials and their manufactured products, as well as five triplets of raw materials, their half-finished and finished products, reveals neither a lag of half-finished products behind raw materials, nor a lag of finished

¹ The word "sensitive" is used here to mean both quickness and magnitude of fluctuations.

products behind half-finished goods or raw materials. The removal of raw materials from the producers' goods does not alter the results. Coefficients of variability, ranging from 8.45 in the case of consumers' goods to 10.98 in the case of producers' manufactured commodities, and to 15.87 in the case of raw materials, harmonize with Mitchell's interpretation, and lend support to Carver's theory that crises arise from the dissimilar price fluctuations of producers' and consumers' goods. That the prices of producers' goods do not characteristically move earlier in point of time than those of consumers' commodities is evidenced by the high degree of concurrent correlation of the three series with each other.

The author's conclusions as to Sombart's theory need qualification. The annual figures paired concurrently show that mineral, forest, and animal products move together, and that these movements are reflected one year later in farm products. Animal products, however, agree more closely with forest and farm products than with minerals. The results indicate that forest products still remain a good index of business conditions, notwithstanding the limitations of supply and conditions of monopoly existing in the industry.

It is obvious that Mitchell is correct in asserting that American wages show a stability superior to both retail and wholesale prices. But, contrary to Mitchell, wages in the British Isles exhibit much the same range of fluctuation as those in the United States. In point of time English wages display a more intimate relation to wholesale prices, and join these in preceding prices at retail; while all three of the American series move together. This difference in the relation of wages to business conditions may be due, not to irregularity or incompleteness of the figures, but to the influence of trade

unionism or to a significant difference in the industrial and commercial conditions in the two countries.

The present analysis thus supports Mitchell in some of his conclusions. In many others the results appear to be inconclusive, and in some cases even contradictory. Probably the safest and most important conclusion of this study is this: annual figures do not suffice. Annual data are open to question because of their non-homogeneous content. For instance, the year 1907 witnessed a period of considerable business activity followed by feverish activity, then collapse and depression; 1908, depression in the beginning and revival in the later months. To unite the figures for the earlier and later months of such years serves not to clarify but to confuse any study of these short-time phenomena. Since a study of crises is perforce a study of these short-time movements, the results are vitiated in the measure that these heterogeneous elements are merged in annual figures. While the lag is in some cases a year, in other cases it is obviously not a year, but some shorter period.¹ The use of annual figures is legitimate as a preliminary step, but not as a basis for final conclusions. It is my conviction that reliable results can be obtained only by a resort to quarterly or monthly data, preferably the former. Mitchell's work marks an epoch. But his study merely points the way. The task yet remains for some one with time and patience to dig out the appropriate data and to continue with more refined methods the inquiry so well begun.

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¹ This view is substantially that expressed by Professor O. M. W. Sprague in a recent review of Mitchell's *Business Cycles*. "When the investigator is concerned with broad general tendencies over a long period of time annual figures serve the purpose. But in the case of the business cycle it is a series of changes which follow one another in rather quick succession that are to be measured." *Journal of Political Economy*, vol. xxiv, p. 609 (June, 1916).